6.9.4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

IN REPLY
REFER TO: OEA-095 April 12, 1999

MEMORANDUM

SUBJECT: Bunker Hill, CLP Metals Analysis, Data Validation
Case: 26799
SDG: MJAF06

FROM: Laura Castrilli, Chemist
Quality Assurance and Data Unit, OEA

TO: Mary Kay Voytilla, Regional Project Manager
Office of Environmental Cleanup

CC: Bruce Woods, Region 10 CLP TPO
Jim Stefanoff, CH2M Hill

The following is a validation of ICP-AES and mercury analyses of nine total and eight dissolved water samples from the Bunker Hill project. The analyses were performed following the USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis Multi-media, Multi-Concentration, ILM04.0. Analyses were conducted by Sentinel, Inc, of Huntsville, Alabama. This validation was conducted for the following samples:

MJAF06	MJAF09	MJAF13	MJAF16	MJAF19	MJAF22
MJAF07	MJAF11	MJAF14	MJAF17	MJAF20	MJAF23
MJAF08	MJAF12	MJAF15	MJAF18	MJAF21	

Data Qualifications

The following comments refer to the Sentinel Laboratory's performance in meeting quality control specifications outlined in the *CLP Statement of Work (CLP-SOW) for Inorganic Analysis, rev. ILM04.0.* The comments presented herein are based on the information provided for the review.

1.0 Timeliness - Acceptable

The technical (40 CFR part 136) holding time from the date of collection for mercury in water is 28 days. The holding time for the remaining metals in water is 180 days. The samples were collected between 01/27/99 and 02/05/99. Mercury analyses were completed on 02/17/99. ICP-AES analyses were completed on 02/25/99.

2.0 Sample Preparation - Acceptable

The samples were prepared for mercury and ICP-AES analyses on 02/16/99.

3.0 Calibrations/Calibration Verifications - Acceptable

The samples were analyzed for mercury by CVAAS on 02/17/99. Initial calibration included one blank and six standards. The curve was linear with a correlation coefficient greater than 0.995.

The samples were analyzed by ICP-AES on 02/19/99, 02/23/99 (fifteen and thirty fold dilutions for iron, manganese and zinc), and 02/25/99 (one hundred fold dilutions for zinc). The instrument was standardized according to the analytical method each day of analysis using one blank and a single calibration standard for each element.

All ICP-AES and CVAAS (mercury) calibrations were performed as required and met the acceptance criteria; therefore, no qualification was made on this basis.

Continuing calibration verifications (CCVs) are required before and after sample analysis and after every 10 samples during analysis. Mercury recoveries must be within 80-120%. Other metal recoveries must be within 90-110%. The frequency of analysis of CCVs was met. All ICP-AES and CVAAS (mercury) CCVs (initial and continuing) bracketing reported sample results met the recovery criteria.

4.0 Laboratory Control Samples - Acceptable

Laboratory Control samples are digested and analyzed along with the samples to verify the efficiency of laboratory procedures. All recoveries associated with reported sample results met the acceptance criteria for control samples.

5.0 Blanks -

Procedural blanks were prepared with the samples to show potential contamination from the digestion or analytical procedure. If an analyte was found in the associated blank, the sample results were qualified if the analyte concentration was less than five times the analytical value in the blank.

No analytes were detected in the preparation blanks. Aluminum, calcium, copper, iron, magnesium, manganese, silver, and zinc were detected in one or more ICP-AES continuing calibration blanks (CCBs). Aluminum, calcium, magnesium, and sodium in some CCBs had negative values with absolute values greater than the respective detection limits. Based on blank contamination, silver in samples MJAF08, MJAF12, and MJAF13 was qualified 'U'.

All other sample results were greater than five times the associated

blank levels (or were already undetected) and were not qualified based on blank contamination.

6.0 ICP-AES Interference Check Sample -

The interference check sample (ICS) is analyzed by ICP-AES to verify interelement and background correction factors. Analysis is required at the beginning and end of each sample analysis run and recoveries must be between 80% and 120%. All ICS recoveries associated with reported sample results were within the recovery criterion; with the exception of copper in the ICS-A samples. The average copper recovery for the three ICS-A samples was 72.6%, the true value for copper is 28 ug/L. The ICS-AB copper true value is 507 ug/L, and all ICS-AB results were within the recovery criteria. Copper results were not qualified on the basis of ICS-A recovery as those samples that had interferent levels of iron had native copper results at least twice the ICS-A copper level.

The raw data for a number of samples had interfering levels of iron. Analytes for which iron is an interferent were qualified as follows:

- Vanadium in samples MJAF06, MJAF07, MJAF11, MJAF15, MJAF17, MJAF20, and MJAF22 was qualified 'UJ', estimated detection limit (possible false negative due to high iron) or 'J' estimated (possible low bias) as vanadium in the three ICS-A analyses bracketing these samples had negative results with absolute values greater than the detection limit.

- Cobalt in sample MJAF06 was qualified 'J' estimated as cobalt in the three ICS-A analyses bracketing this sample had results greater than the detection limit (possible high bias - estimated cobalt due to iron interference was greater than 25% of the cobalt level).

Some of the samples required one or more dilution runs to report zinc, iron, and manganese results within the instrumental linear range. The raw data for all analytes were compared using the available dilutions to see if 1) zinc, iron, and/or manganese levels in the undiluted samples were high enough that interelement corrections may not be sufficient for the analytes that were reported from the undiluted analyses or 2) a pattern of suppression or enhancement was evident.

From this comparative study, the following results were qualified due to suspected interference (analytes already qualified due to interference or due to poor serial dilution results were not qualified again, see section 11 for qualification due to serial dilution):

- Aluminum, copper, and lead were qualified 'J', estimated (pattern of enhancement/possible high bias for aluminum; pattern of suppression/possible low bias for the other analytes) in sample MJAF06.
- Silver, thallium, and sodium were qualified 'J', estimated

(pattern of enhancement/possible high bias for sodium; pattern of suppression/possible low bias for the other analytes) in sample MJAF07.

- Cadmium, magnesium, thallium, and sodium were qualified 'J', estimated (pattern of enhancement/possible high bias for sodium; pattern of suppression/possible low bias for the other analytes) in sample MJAF11.
- Silver, aluminum, arsenic, cadmium, cobalt, copper, magnesium, nickel, lead, and sodium were qualified 'J', estimated (pattern of enhancement/possible high bias for sodium; pattern of suppression/possible low bias for the other analytes) in samples MJAF17 and MJAF22.
- Sodium was qualified 'J', estimated (pattern of enhancement/possible high bias) in sample MJAF20.

7.0 Duplicate Analysis - Acceptable

Duplicate analyses were done on sample MJAF08. Water duplicate results were within the ±20% Relative Percent Difference (RPD) or ±CRDL criteria for water results < 5 times the CRDL criteria. No qualification was made on this basis.

8.0 Field Duplicate Analysis - Not Applicable

Field duplicate analysis for samples in this SDG was not indicated in the field collection documentation.

9.0 Matrix Spike Analysis -

Matrix spike sample analyses are done to provide information about the effect of the sample matrix on digestion and measurement methods. Matrix spike recovery must be within the limits of 75 - 125%.

Matrix spike analyses were done on sample MJAF08. All matrix spike recoveries were within the required QC limits, with the exception of antimony (68.9% recovery). All antimony results were qualified 'J', estimated (possible low bias).

10.0 Graphite Furnace Atomic Absorption Spec (GFAAS) QC - Not Applicable -

GFAAS was not used for the analysis of these samples.

11.0 ICP-AES Serial Dilution -

Sample MJAF08 was analyzed by ICP-AES serial dilution to check for potential interferences. All analytes which exceeded the minimum concentration criterion (50 times the IDL) agreed within the 10%D criteria; with the exception of calcium (77.3%), potassium (19.1%), and zinc (12.6%). All calcium, potassium and zinc results were qualified 'J', estimated due to serial dilution results.

12.0 Detection Limits - Acceptable

Sample results which fall below the instrument detection limit (IDL) are assigned the value of the instrument detection limit and the 'U' qualifier is attached. Contract Required Detection Limit (CRDL) standards are required to demonstrate a linear calibration curve near the CRDL. CRDL standards were run at the required frequency.

13.0 Overall Assessment of the Data

This validation of the data is based on the criteria outlined in the *National Functional Guidelines for Inorganic Data Review (02/94)*. Approximately 25.6% of the data was qualified based on blank contamination, interference, matrix spike recovery, or poor serial dilution results. The data as qualified is acceptable for all purposes.

Below are the definitions for the National Functional Guidelines for Inorganic Data Review (02/94) qualifiers used when validating/qualifying data from Inorganic analysis.

DATA QUALIFIERS

U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

J - The associated value is an estimated quantity.

R - The data are unusable. (Note: Analyte may or may not be present.)

UJ - The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF06

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 17961S

Level (low/med): LOW Date Received: 01/28/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4110		J	P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	3.7	U		P
7440-39-3	Barium	3.6	B		P
7440-41-7	Beryllium	1.3	B		P
7440-43-9	Cadmium	490			P
7440-70-2	Calcium	17200		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	45.6	B	J	P
7440-50-8	Copper	78.0		J	P
7439-89-6	Iron	483000			P
7439-92-1	Lead	1310		J	P
7439-95-4	Magnesium	54400			P
7439-96-5	Manganese	102000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	74.6			P
7440-09-7	Potassium	775	B	~~E~~ J	P
7782-49-2	Selenium	31.1			P
7440-22-4	Silver	39.1			P
7440-23-5	Sodium	2130	B		P
7440-28-0	Thallium	17.7			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	72100		~~E~~ J	P
	Cyanide				NR

2/2 04/28/99

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF07

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 17962S

Level (low/med): LOW Date Received: 01/28/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	312000			P
7440-36-0	Antimony	143		N J	P
7440-38-2	Arsenic	7580			P
7440-39-3	Barium	6.9	B		P
7440-41-7	Beryllium	7.1			P
7440-43-9	Cadmium	12400			P
7440-70-2	Calcium	7210		E J	P
7440-47-3	Chromium	55.4			P
7440-48-4	Cobalt	371			P
7440-50-8	Copper	34200			P
7439-89-6	Iron	2900000			P
7439-92-1	Lead	63.2			P
7439-95-4	Magnesium	35800			P
7439-96-5	Manganese	8740			P
7439-97-6	Mercury	0.79			CV
7440-02-0	Nickel	463			P
7440-09-7	Potassium	106	B	E J	P
7782-49-2	Selenium	76.7			P
7440-22-4	Silver	53.6		J	P
7440-23-5	Sodium	244000		J	P
7440-28-0	Thallium	4.9	U	J	P
7440-62-2	Vanadium	24.6	B	J	P
7440-66-6	Zinc	3210000		E J	P
	Cyanide				NR

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF08

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 17963S

Level (low/med): LOW Date Received: 01/28/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	459			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	6.0	B		P
7440-39-3	Barium	3.0	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	0.89	B		P
7440-70-2	Calcium	2200	B	~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	2.6	B		P
7440-50-8	Copper	185			P
7439-89-6	Iron	172			P
7439-92-1	Lead	59.4			P
7439-95-4	Magnesium	628	B		P
7439-96-5	Manganese	71.9			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	3.9	B		P
7440-09-7	Potassium	838	B	~~E~~ J	P
7782-49-2	Selenium	3.1	U		P
7440-22-4	Silver	0.84	~~B~~ U		P
7440-23-5	Sodium	520	B		P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	121		~~E~~ J	P
	Cyanide				NR

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF09

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 17964S

Level (low/med): LOW Date Received: 01/28/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	587			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	9.6	B		P
7440-39-3	Barium	3.4	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	4.4	B		P
7440-70-2	Calcium	2270	B	~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	2.4	B		P
7440-50-8	Copper	200			P
7439-89-6	Iron	886			P
7439-92-1	Lead	55.8			P
7439-95-4	Magnesium	616	B		P
7439-96-5	Manganese	72.3			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	3.4	B		P
7440-09-7	Potassium	795	B	~~E~~ J	P
7782-49-2	Selenium	3.1	U		P
7440-22-4	Silver	0.70	U		P
7440-23-5	Sodium	561	B		P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	911		~~E~~ J	P
_____	Cyanide				NR

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF11

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 17965S

Level (low/med): LOW Date Received: 01/28/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	341000			P
7440-36-0	Antimony	145		~~N~~ J	P
7440-38-2	Arsenic	7650			P
7440-39-3	Barium	13.4	B		P
7440-41-7	Beryllium	8.0			P
7440-43-9	Cadmium	12900		J	P
7440-70-2	Calcium	7550		~~E~~ J	P
7440-47-3	Chromium	59.2			P
7440-48-4	Cobalt	393			P
7440-50-8	Copper	36300			P
7439-89-6	Iron	3300000			P
7439-92-1	Lead	80.6			P
7439-95-4	Magnesium	38600		J	P
7439-96-5	Manganese	9430			P
7439-97-6	Mercury	0.37			CV
7440-02-0	Nickel	491			P
7440-09-7	Potassium	211	B	~~E~~ J	P
7782-49-2	Selenium	72.6			P
7440-22-4	Silver	35.8			P
7440-23-5	Sodium	262000		J	P
7440-28-0	Thallium	4.9	U	J	P
7440-62-2	Vanadium	26.1	B	J	P
7440-66-6	Zinc	3570000		~~E~~ J	P
	Cyanide				NR

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF12

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 17966S

Level (low/med): LOW Date Received: 01/28/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	595			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	11.5			P
7440-39-3	Barium	3.8	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	7.8			P
7440-70-2	Calcium	2140	B	~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	2.4	B		P
7440-50-8	Copper	192			P
7439-89-6	Iron	1510			P
7439-92-1	Lead	60.6			P
7439-95-4	Magnesium	620	B		P
7439-96-5	Manganese	72.8			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	3.1	U		P
7440-09-7	Potassium	800	B	E J	P
7782-49-2	Selenium	3.1	U		P
7440-22-4	Silver	1.1	~~B~~ U		P
7440-23-5	Sodium	493	B		P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	1620		E J	P
	Cyanide				NR

04/08/99

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF13

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 17967S

Level (low/med): LOW Date Received: 01/28/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	527			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	4.5	B		P
7440-39-3	Barium	13.7	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	2.6	B		P
7440-70-2	Calcium	2140	B	~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	2.7	B		P
7440-50-8	Copper	285			P
7439-89-6	Iron	459			P
7439-92-1	Lead	48.3			P
7439-95-4	Magnesium	611	B		P
7439-96-5	Manganese	70.2			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	3.1	U		P
7440-09-7	Potassium	832	B	~~E~~ J	P
7782-49-2	Selenium	3.1	U		P
7440-22-4	Silver	1.0	~~B~~ U		P
7440-23-5	Sodium	644	B		P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	582		~~E~~ J	P
	Cyanide				NR

01/28/99

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Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF14

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 18072S

Level (low/med): LOW Date Received: 02/06/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	747			P
7440-36-0	Antimony	6.5	B	~~N~~ J	P
7440-38-2	Arsenic	124			P
7440-39-3	Barium	16.4	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	115			P
7440-70-2	Calcium	8530		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	18.6	B		P
7440-50-8	Copper	185			P
7439-89-6	Iron	55600			P
7439-92-1	Lead	1160			P
7439-95-4	Magnesium	6850			P
7439-96-5	Manganese	8190			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	20.4	B		P
7440-09-7	Potassium	1490	B	~~E~~ J	P
7782-49-2	Selenium	3.1	U		P
7440-22-4	Silver	4.4	B		P
7440-23-5	Sodium	1170	B		P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	28700		~~E~~ J	P
	Cyanide				NR

JMC 04/26/99

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF15

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 18073S

Level (low/med): LOW Date Received: 02/06/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	9940			P
7440-36-0	Antimony	7.6	B	~~N~~ J	P
7440-38-2	Arsenic	897			P
7440-39-3	Barium	9.3	B		P
7440-41-7	Beryllium	5.4			P
7440-43-9	Cadmium	1060			P
7440-70-2	Calcium	35500		~~E~~ J	P
7440-47-3	Chromium	6.7	B		P
7440-48-4	Cobalt	138			P
7440-50-8	Copper	653			P
7439-89-6	Iron	929000			P
7439-92-1	Lead	648			P
7439-95-4	Magnesium	79700			P
7439-96-5	Manganese	101000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	150			P
7440-09-7	Potassium	660	B	~~E~~ J	P
7782-49-2	Selenium	43.4			P
7440-22-4	Silver	37.9			P
7440-23-5	Sodium	22200			P
7440-28-0	Thallium	13.1			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	465000		~~E~~ J	P
	Cyanide				NR

3/R 04/08/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF16

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 18074S

Level (low/med): LOW Date Received: 02/06/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	485			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	16.8			P
7440-39-3	Barium	22.3	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	49.3			P
7440-70-2	Calcium	10600		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	6.5	B		P
7440-50-8	Copper	36.6			P
7439-89-6	Iron	14000			P
7439-92-1	Lead	175			P
7439-95-4	Magnesium	16600			P
7439-96-5	Manganese	8380			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	8.1	B		P
7440-09-7	Potassium	799	B	~~E~~ J	P
7782-49-2	Selenium	3.1	U		P
7440-22-4	Silver	3.3	B		P
7440-23-5	Sodium	950	B		P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	16500		~~E~~ J	P
	Cyanide				NR

4/06/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF17

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 18075S

Level (low/med): LOW Date Received: 02/06/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	30400		J	P
7440-36-0	Antimony	37.6	B	N J	P
7440-38-2	Arsenic	2920		J	P
7440-39-3	Barium	9.5	B		P
7440-41-7	Beryllium	16.6			P
7440-43-9	Cadmium	3060		J	P
7440-70-2	Calcium	78200		E J	P
7440-47-3	Chromium	17.6			P
7440-48-4	Cobalt	406		J	P
7440-50-8	Copper	1890		J	P
7439-89-6	Iron	3500000			P
7439-92-1	Lead	331		J	P
7439-95-4	Magnesium	142000		J	P
7439-96-5	Manganese	337000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	424		J	P
7440-09-7	Potassium	400	B	E J	P
7782-49-2	Selenium	78.7			P
7440-22-4	Silver	53.9		J	P
7440-23-5	Sodium	105000		J	P
7440-28-0	Thallium	73.4			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	1920000		E J	P
	Cyanide				NR

04/25/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF18

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 18076S

Level (low/med): LOW Date Received: 02/06/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	727			P
7440-36-0	Antimony	5.9	B	~~N~~ J	P
7440-38-2	Arsenic	131			P
7440-39-3	Barium	15.8	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	118			P
7440-70-2	Calcium	8690		E J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	18.8	B		P
7440-50-8	Copper	187			P
7439-89-6	Iron	57300			P
7439-92-1	Lead	1160			P
7439-95-4	Magnesium	6950			P
7439-96-5	Manganese	8290			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	20.1	B		P
7440-09-7	Potassium	1500	B	E J	P
7782-49-2	Selenium	3.1	U		P
7440-22-4	Silver	4.6	B		P
7440-23-5	Sodium	1160	B		P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	29200		E J	P
_____	Cyanide				NR

SK 04/08/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

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EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF19

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 18077S

Level (low/med): LOW Date Received: 02/06/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	679			P
7440-36-0	Antimony	3.5	U	~~N~~ J	P
7440-38-2	Arsenic	78.4			P
7440-39-3	Barium	19.0	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	113			P
7440-70-2	Calcium	7730		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	16.8	B		P
7440-50-8	Copper	185			P
7439-89-6	Iron	47400			P
7439-92-1	Lead	1070			P
7439-95-4	Magnesium	6340			P
7439-96-5	Manganese	7530			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	18.4	B		P
7440-09-7	Potassium	1420	B	~~E~~ J	P
7782-49-2	Selenium	3.1	U		P
7440-22-4	Silver	3.6	B		P
7440-23-5	Sodium	1080	B		P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	27600		~~E~~ J	P
	Cyanide				NR

AK 04/08/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF20

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 18078S

Level (low/med): LOW Date Received: 02/06/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10100			P
7440-36-0	Antimony	11.3	B	~~N~~ J	P
7440-38-2	Arsenic	900			P
7440-39-3	Barium	14.2	B		P
7440-41-7	Beryllium	5.5			P
7440-43-9	Cadmium	1070			P
7440-70-2	Calcium	35400		~~E~~ J	P
7440-47-3	Chromium	6.6	B		P
7440-48-4	Cobalt	140			P
7440-50-8	Copper	570			P
7439-89-6	Iron	937000			P
7439-92-1	Lead	656			P
7439-95-4	Magnesium	80000			P
7439-96-5	Manganese	102000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	150			P
7440-09-7	Potassium	746	B	~~E~~ J	P
7782-49-2	Selenium	36.2			P
7440-22-4	Silver	35.1			P
7440-23-5	Sodium	22900		J	P
7440-28-0	Thallium	13.8			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	462000		~~E~~ J	P
	Cyanide				NR

04/08/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF21

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 18079S

Level (low/med): LOW Date Received: 02/06/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	427			P
7440-36-0	Antimony	3.5	U	~~NJ~~	P
7440-38-2	Arsenic	8.5	B		P
7440-39-3	Barium	28.8	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	47.6			P
7440-70-2	Calcium	9820		~~EJ~~	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	6.5	B		P
7440-50-8	Copper	23.8	B		P
7439-89-6	Iron	9090			P
7439-92-1	Lead	164			P
7439-95-4	Magnesium	16100			P
7439-96-5	Manganese	8030			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	6.9	B		P
7440-09-7	Potassium	810	B	~~EJ~~	P
7782-49-2	Selenium	3.1	U		P
7440-22-4	Silver	3.3	B		P
7440-23-5	Sodium	1000	B		P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	15900		~~EJ~~	P
	Cyanide				NR

04/08/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF22

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 18080S

Level (low/med): LOW Date Received: 02/06/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	33400		J	P
7440-36-0	Antimony	46.1	B	~~N~~ J	P
7440-38-2	Arsenic	3220		J	P
7440-39-3	Barium	15.6	B		P
7440-41-7	Beryllium	18.0			P
7440-43-9	Cadmium	3300		J	P
7440-70-2	Calcium	83900		~~E~~ J	P
7440-47-3	Chromium	20.2			P
7440-48-4	Cobalt	442		J	P
7440-50-8	Copper	2050		J	P
7439-89-6	Iron	3980000			P
7439-92-1	Lead	350		J	P
7439-95-4	Magnesium	155000		J	P
7439-96-5	Manganese	378000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	463		J	P
7440-09-7	Potassium	437	B	~~E~~ J	P
7782-49-2	Selenium	59.3			P
7440-22-4	Silver	51.1		J	P
7440-23-5	Sodium	116000		J	P
7440-28-0	Thallium	63.1			P
7440-62-2	Vanadium	1.4	U	J	P
7440-66-6	Zinc	2070000		~~E~~ J	P
	Cyanide				NR

AM 4/26/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MJAF23

Lab Name: SENTINEL, INC. Contract: 68-D6-0001

Lab Code: SENTIN Case No.: 26799 SAS No.: SDG No.: MJAF06

Matrix (soil/water): WATER Lab Sample ID: 18081S

Level (low/med): LOW Date Received: 02/06/99

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	793			P
7440-36-0	Antimony	3.6	B	~~N~~ J	P
7440-38-2	Arsenic	80.4			P
7440-39-3	Barium	22.8	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	132			P
7440-70-2	Calcium	8920		~~E~~ J	P
7440-47-3	Chromium	0.70	U		P
7440-48-4	Cobalt	19.2	B		P
7440-50-8	Copper	241			P
7439-89-6	Iron	54200			P
7439-92-1	Lead	1260			P
7439-95-4	Magnesium	7330			P
7439-96-5	Manganese	8650			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	41.1			P
7440-09-7	Potassium	1620	B	~~E~~ J	P
7782-49-2	Selenium	3.1	U		P
7440-22-4	Silver	4.4	B		P
7440-23-5	Sodium	1370	B		P
7440-28-0	Thallium	4.9	U		P
7440-62-2	Vanadium	1.4	U		P
7440-66-6	Zinc	32300		~~E~~ J	P
	Cyanide				NR

4/12 04/06/99

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments: